TB and Diabetes

Diabetes in North Dakota
Risks and Recommendations

OCTOBER 28, 2020

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The HIV/STD/TB/Hepatitis Program and the Dakotas AIDS Education and Training Center (DAETC) conduct monthly Lunch and Learn Webinars for health care professionals in North and South Dakota.

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Diabetes in North Dakota

ADDRESSING PATIENT NEEDS

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North Dakota Department of Health, Division of Health Promotion
Healthy and Safe Communities Section

Objectives

1. Understand recent trends in diabetes in ND
2. Identify risk factors and screening criteria for diabetes
3. Become familiar with resources available to patients with or at risk for diabetes

Diabetes in America

34.2 million Americans have diabetes

- Estimated 1 in 5 is undiagnosed
- Incidence in adults decreased 2008-2018, increased for non-white youth

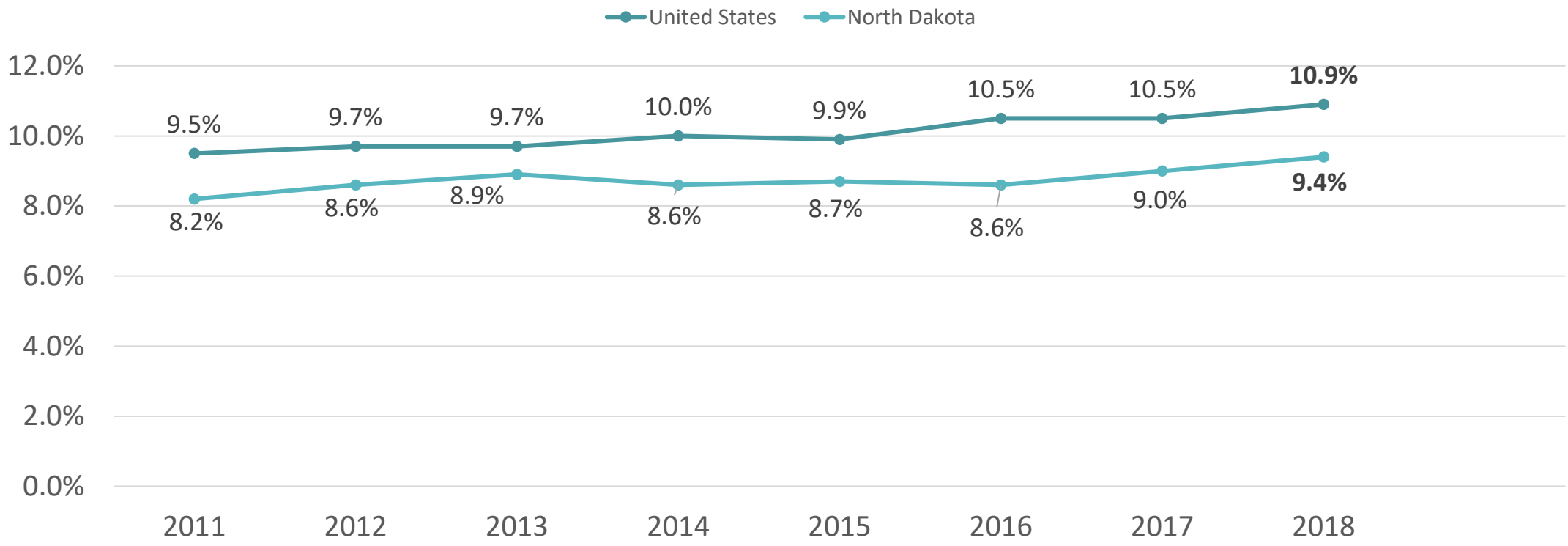
90-95% of cases are Type 2

7th leading cause of death

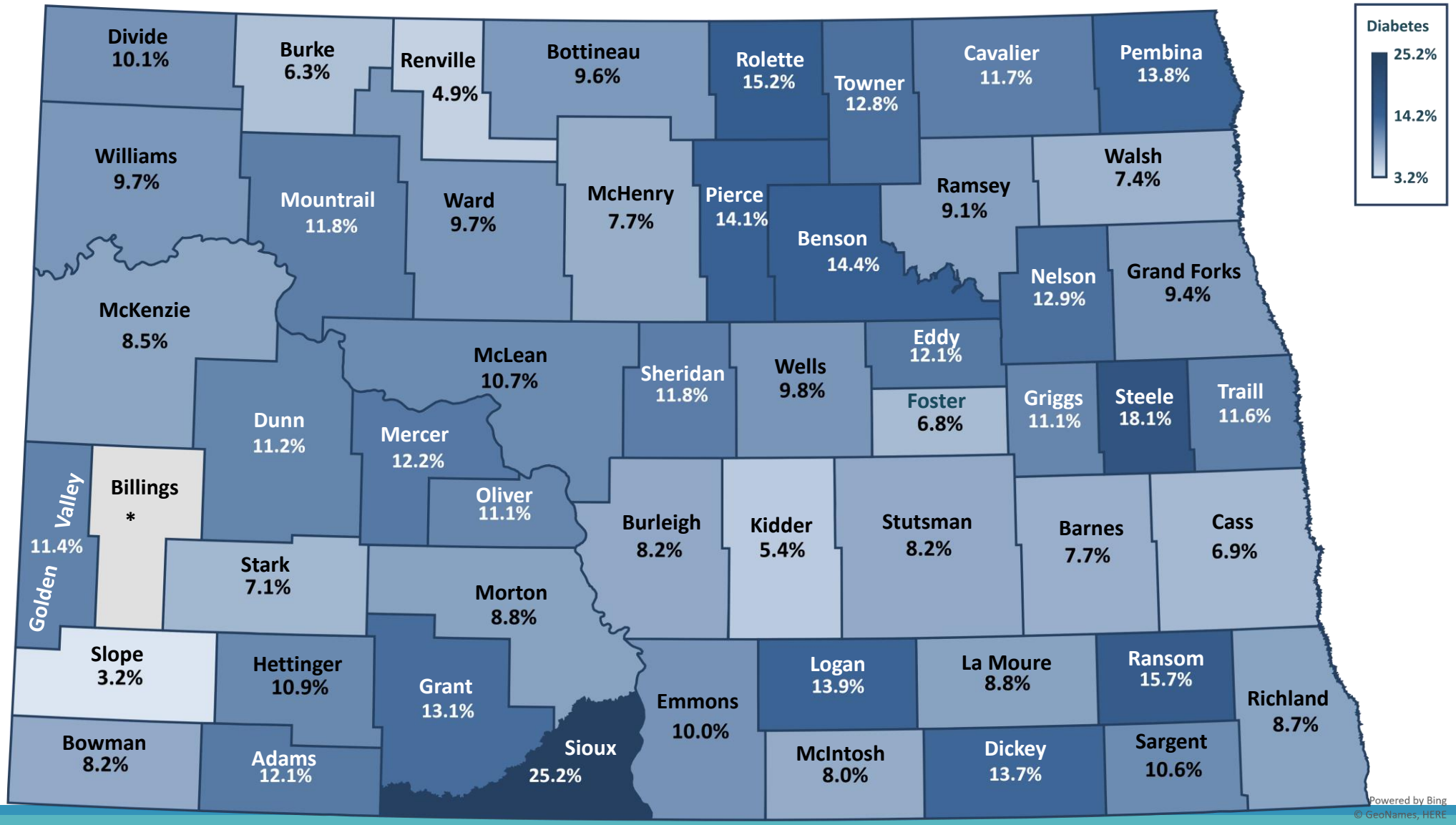
Diabetes cost Americans $327 billion in 2018

- 26% increase in costs over 5 years
- 1 in 7 dollars in the healthcare system is spent on diabetes

Diabetes in North Dakota



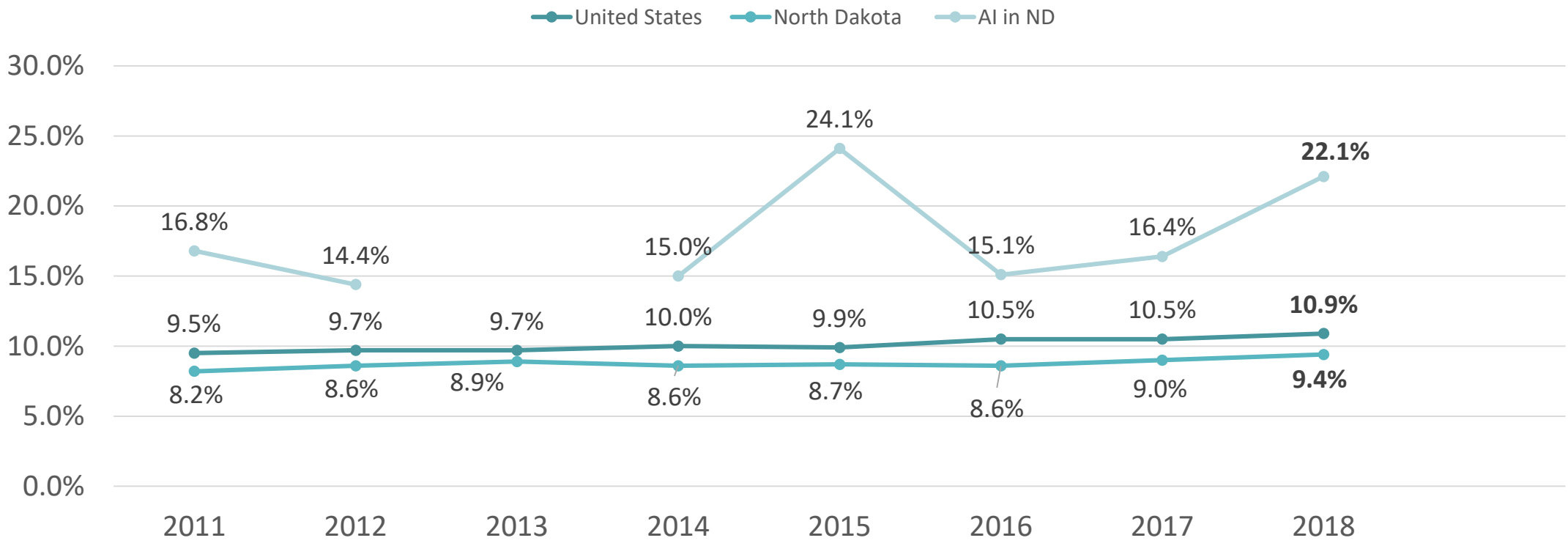
2014-2018 North Dakota Adult Diabetes Prevalence



*Suppressed due to insufficient sample size.

Source: North Dakota Behavior Risk Factor Surveillance System (BRFSS)

Diabetes in North Dakota



Disparities Among American Indians

2.3 times more likely to have diabetes than white counterparts

6 times more likely to die from the disease

4th leading cause of death nationally among AI

- MHA Nation reported diabetes as the top condition in their healthcare system

AI children ages 10-19 are **nine times** more likely to be diagnosed with Type 2 diabetes

Increased prevalence of contributing risk factors

- Obesity
- Tobacco

Low access to quality healthcare

- Lack of providers in rural areas
- Low rates of AI providers
- Bias (implicit or overt) in the system

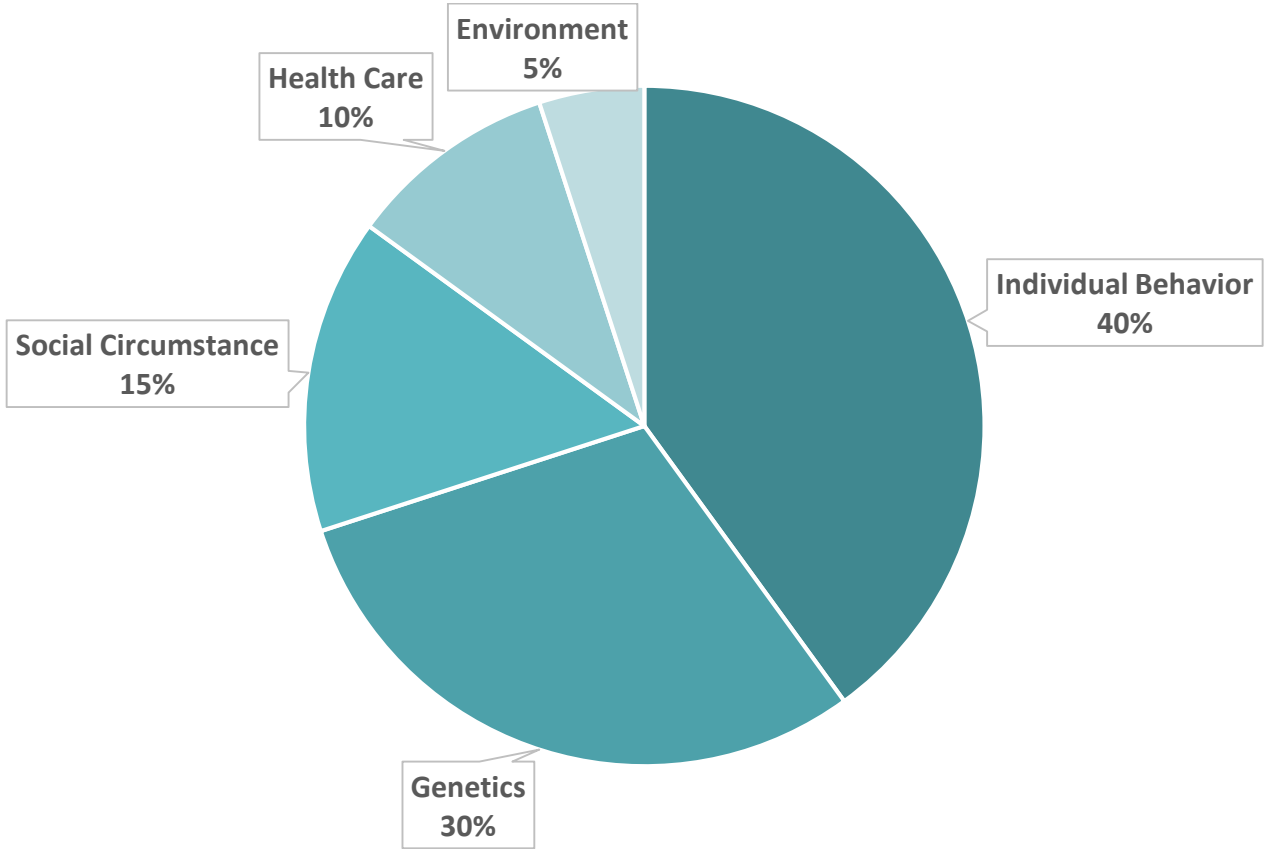
Food access and affordability

Economic Stability

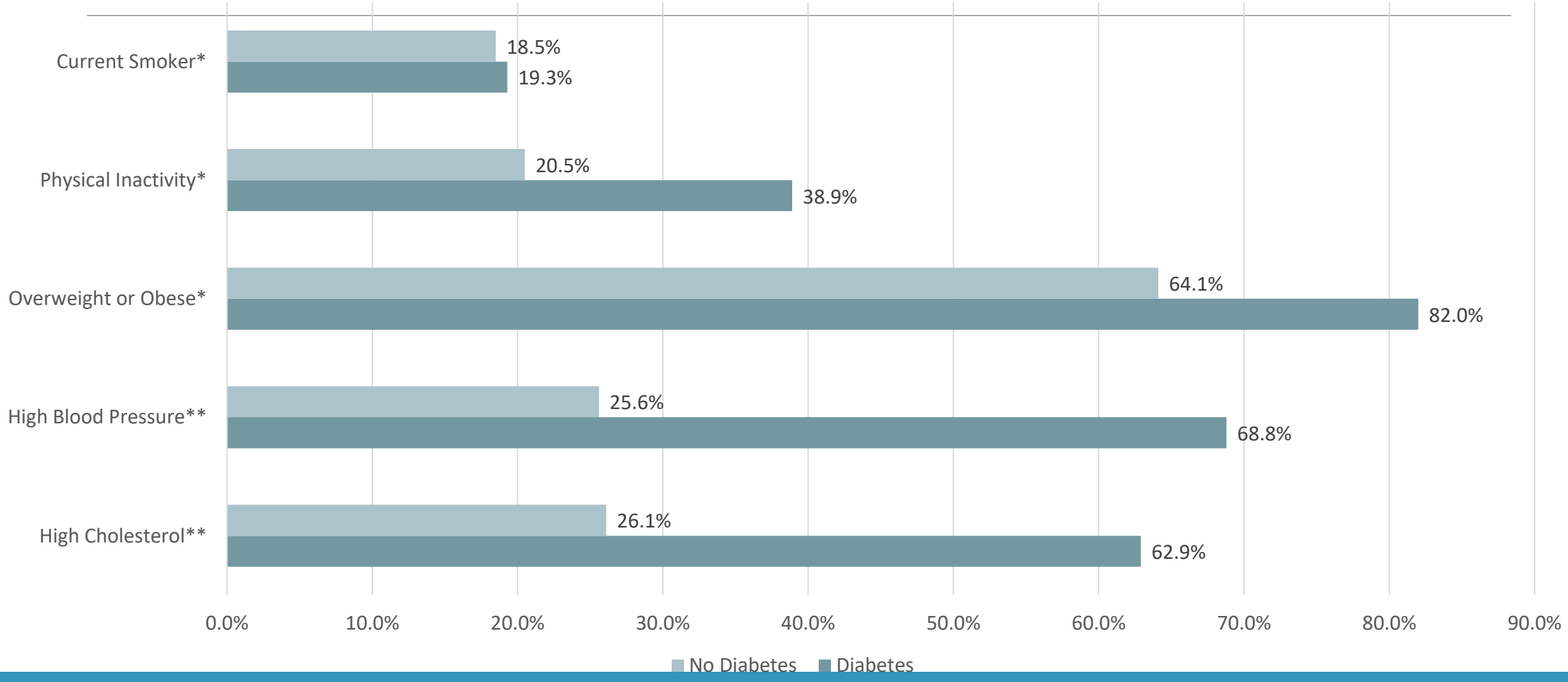
Social Determinants of Health

ECONOMIC STABILITY	NEIGHBORHOOD & PHYSICAL ENVIRONMENT	EDUCATION	FOOD	COMMUNITY & SOCIAL CONTEXT	HEALTHCARE SYSTEM
Employment Income Expenses Debt Medical Bills Support	Housing Transportation Safety Parks Playgrounds Walkability	Literacy Language Early Childhood Education Vocational Training Higher Education	Hunger Access to Healthy Options	Social Integration Support Systems Community Engagement Discrimination	Health Provider Availability Provider Linguistic and Cultural Competency Quality of Care
Health Outcomes Mortality, Morbidity, Life Expectancy, Health Care expenditures, Health Status, Functional Limitations					

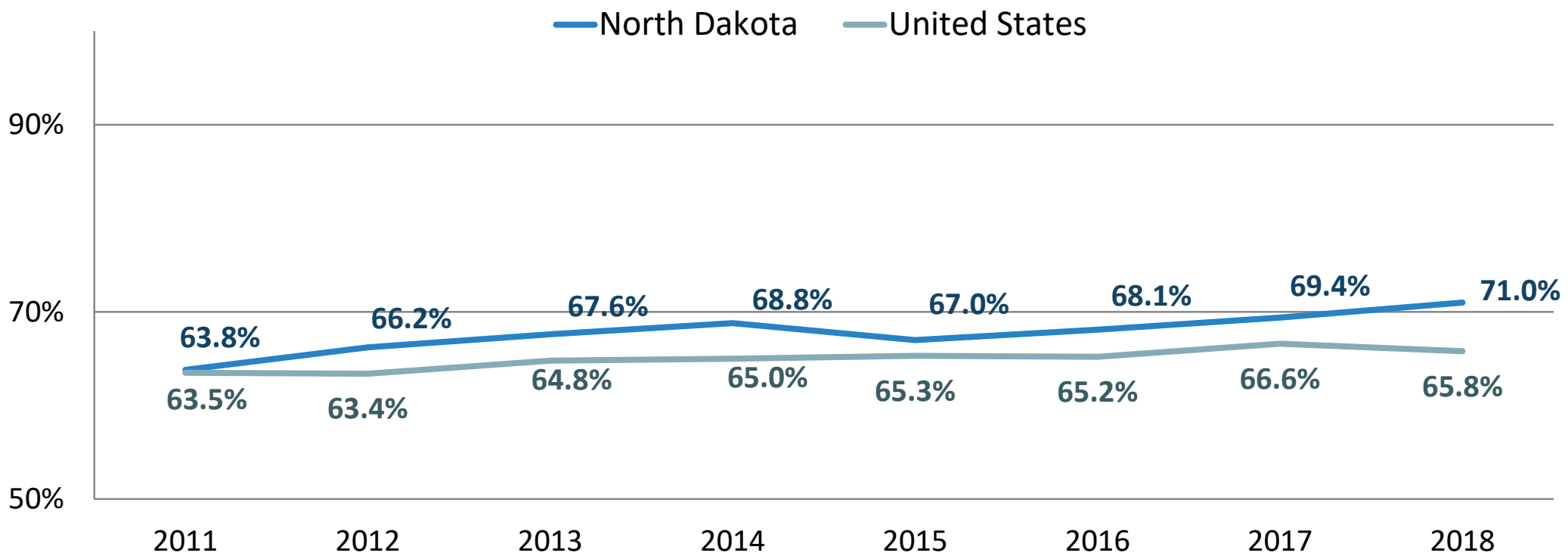
Determinants of Overall Health



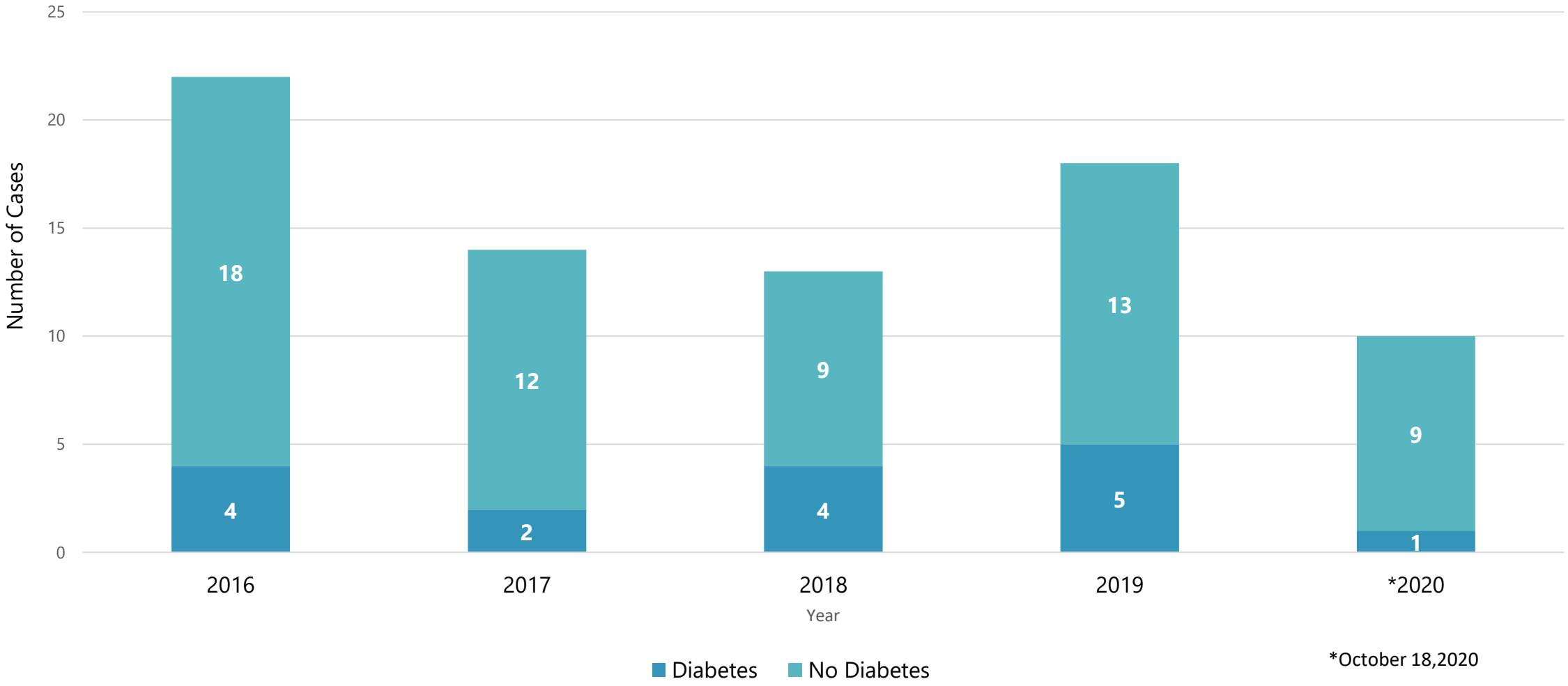
Risk Factors for Diabetes



Overweight & Obesity in ND



Diabetes Risk Factor Active Cases 2016-2020



*October 18,2020

Opportunities for Prevention

An estimated 1 in 3 American adults has prediabetes

The yearly incidence of type 2 diabetes is 5%–10% in people with prediabetes, compared to about 1% per year in the general adult population

Providers have an opportunity to intervene and help patients delay or avoid the onset of diabetes

- Screening with the prediabetes risk test
- Testing and diagnosing
  - HbA1c (5.7% to 6.4%)
  - Fasting blood glucose (100-125 mg/dL)
  - 2-hour oral glucose (140-199 mg/dL)
- Referring to the National Diabetes Prevention Program
  - May reduce incidence of type 2 diabetes by 58%

DO YOU HAVE PREDIABETES?

Prediabetes Risk Test

1. How old are you?
   - Less than 40 years (0 points)
   - 40—49 years (1 point)
   - 50—59 years (2 points)
   - 60 years or older (3 points)
2. Are you a man or a woman?
   - Man (1 point)
   - Woman (0 points)
3. If you are a woman, have you ever been diagnosed with gestational diabetes?
   - Yes (1 point)
   - No (0 points)
4. Do you have a mother, father, sister, or brother with diabetes?
   - Yes (1 point)
   - No (0 points)
5. Have you ever been diagnosed with high blood pressure?
   - Yes (1 point)
   - No (0 points)
6. Are you physically active?
   - Yes (0 points)
   - No (1 point)
7. What is your weight status? (see chart at right)

Write your score in the box.

Height	Weight (lbs.)		
4' 10"	119-142	143-190	191+
4' 11"	124-147	148-197	198+
5' 0"	128-152	153-203	204+
5' 1"	132-157	158-210	211+
5' 2"	136-163	164-217	218+
5' 3"	141-168	169-224	225+
5' 4"	145-173	174-231	232+
5' 5"	150-179	180-239	240+
5' 6"	155-185	186-246	247+
5' 7"	159-190	191-254	255+
5' 8"	164-196	197-261	262+
5' 9"	169-202	203-269	270+
5' 10"	174-208	209-277	278+
5' 11"	179-214	215-285	286+
6' 0"	184-220	221-293	294+
6' 1"	189-226	227-301	302+
6' 2"	194-232	233-310	311+
6' 3"	200-239	240-318	319+
6' 4"	205-245	246-327	328+
	(1 Point)	(2 Points)	(3 Points)
	You weigh less than the amount in the left column (0 points)		

Add up your score.

Adapted from Bang et al., Ann Intern Med 151:775-783, 2009.
Original algorithm was validated without gestational diabetes as part of the model.

If you scored 5 or higher:

You're likely to have prediabetes and are at high risk for type 2 diabetes. However, only your doctor can tell for sure if you do have type 2 diabetes or prediabetes (a condition that precedes type 2 diabetes in which blood glucose levels are higher than normal). Talk to your doctor to see if additional testing is needed.

Type 2 diabetes is more common in African Americans, Hispanic/Latinos, American Indians, Asian Americans and Pacific Islanders.

Higher body weights increase diabetes risk for everyone. Asian Americans are at increased diabetes risk at lower body weights than the rest of the general public (about 15 pounds lower).

RISK TEST — American Diabetes Association. — COURTESY OF

LOWER YOUR RISK

Here's the good news: it is possible with small steps to reverse prediabetes - and these measures can help you live a longer and healthier life.

If you are at high risk, the best thing to do is contact your doctor to see if additional testing is needed.

Visit DoIHavePrediabetes.org for more information on how to make small lifestyle changes to help lower your risk.

For more information, visit us at

DoIHavePrediabetes.org

Ad Council · American Diabetes Association. · AMA American Medical Association · CDC

The National Diabetes Prevention Program (N-DPP)

- An evidence-based lifestyle change program with CDC-recognition, utilizing a standardized curriculum
- Involves a one-year intervention to address prediabetes and delay or prevent type 2 diabetes from developing.
- Sessions are led by trained Lifestyle Coaches
- Sessions teach strategies for healthy eating, weight loss, stress management, physical activity and more
- Beginning in 2021, ND organizations will have the opportunity to provide classes in-person, via distance learning, or self-paced and 100% online
- Covered benefit by Sanford Health Plan, BCBSND, and Medicare
- Referrals can be made through www.NDC3.org

INCREASED
PHYSICAL ACTIVITY

HEALTHY EATING

STRESS MANAGEMENT &
BEHAVIORAL MODIFICATIONS

Other Resources for Patient Care

Diabetes Self-Management Education and Support programs

- Provided by RDN, RN, or Pharmacist- provides patient with skills to better manage their diabetes. Patients should receive DSMES services at least 1x/year
- Programs are available throughout the state with telehealth options available with CMS COVID-19-related waivers
- https://www.diabeteseducator.org/living-with-diabetes/find-an-education-program

Community pharmacies may serve as resources in communities with limited healthcare facilities

Ask of Providers

Be aware of what patients you encounter that may be at elevated risk for developing diabetes and be an advocate for prevention

Poor management of existing diabetes will exacerbate other comorbidities and increase risk of future complications

- Consider what social determinants of health may be impacting patients' management and what resources you may be able to guide them to

Believe that people can make successful behavior given the right support

References

- The Behavioral Risk Factor Surveillance System (BRFSS) , 2011-2018
- Determinants of Health and Their Contribution to Premature Death. Adapted from McGinnis et al. Copyright 2007 Massachusetts Medical Society.
- North Dakota 2020 Diabetes Report, North Dakota Century Code 23-01-40

TB and Diabetes:
Risks and Recommendations

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HIV/STD/TB/Viral Hepatitis Lunch and Learn
October 28, 2020

Association between diabetes mellitus and active tuberculosis:

A systematic review and meta-analysis

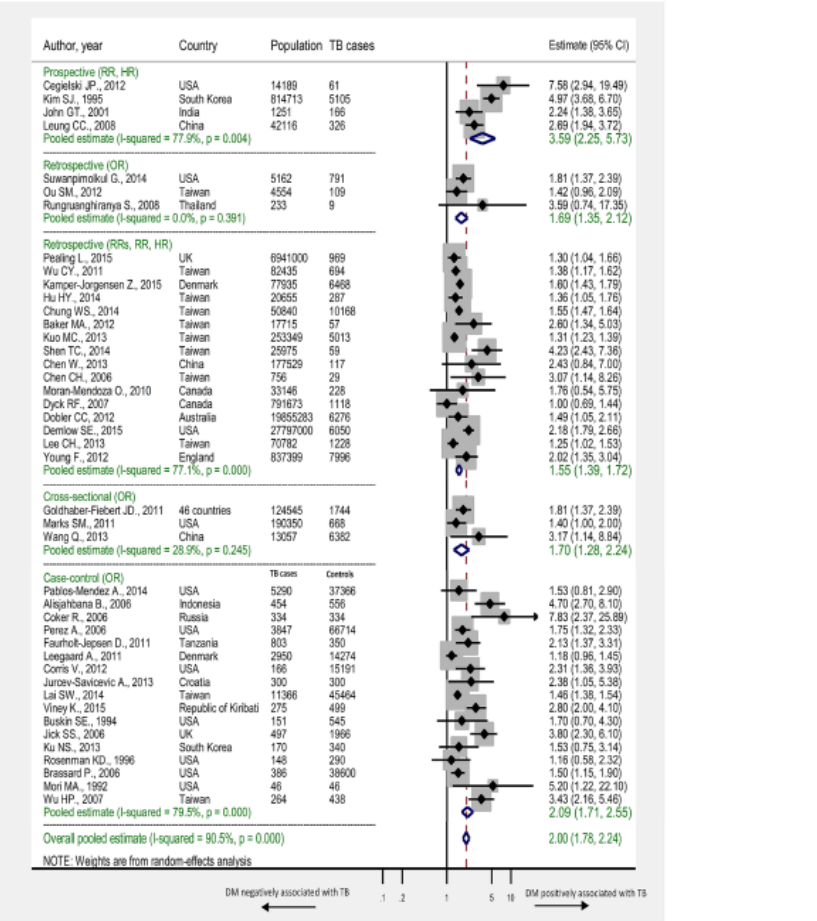


Fig 2. Forest plot of the meta-analyses. Pooled findings of 44 studies reporting adjusted estimates of the association between TB and DM, stratified according to study design. Size of the square is proportional to the precision (weight) of the study-specific effect estimates. Circle is the study–specific effect point estimate. Arrows indicate that the bars are truncated to fit the plot. The diamond is centered on the summary effect estimate, and the width indicates the corresponding 95% CI. RRs: relative risk; RR: rate ratio; OR: odds ratio; HR: hazard ratio.

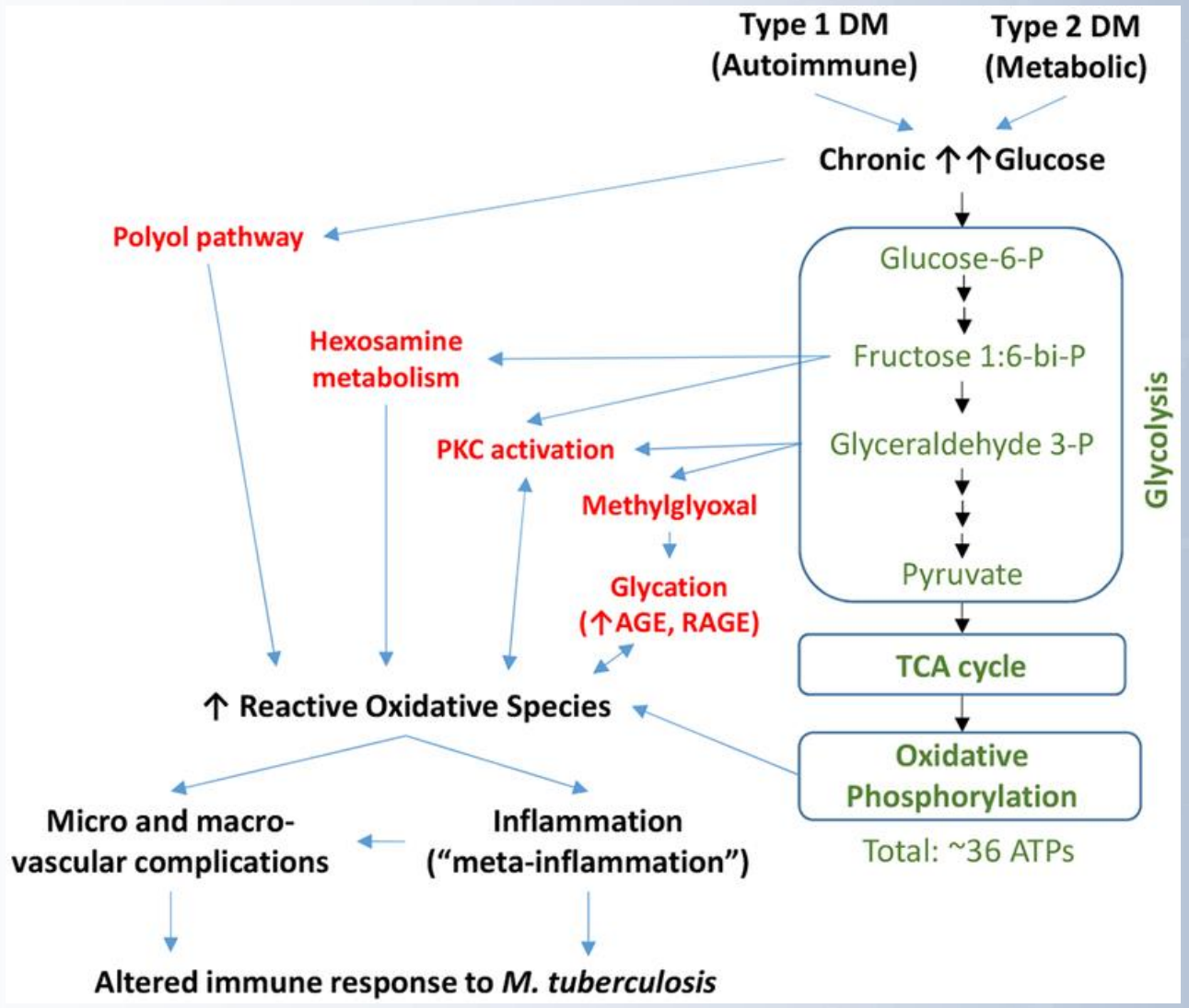
Increase in risk

- By study type
  - 3.59-fold (prospective)
  - 1.55-fold (retrospective)
  - 2.09-fold (case-control)
- By country income level
  - 3.16 fold low/middle income vs. 1.73-fold in high income
- By geographical region
  - 2.44-fold in Asia
  - 1.71-fold in Europe
  - 1.73-fold in USA/Canada

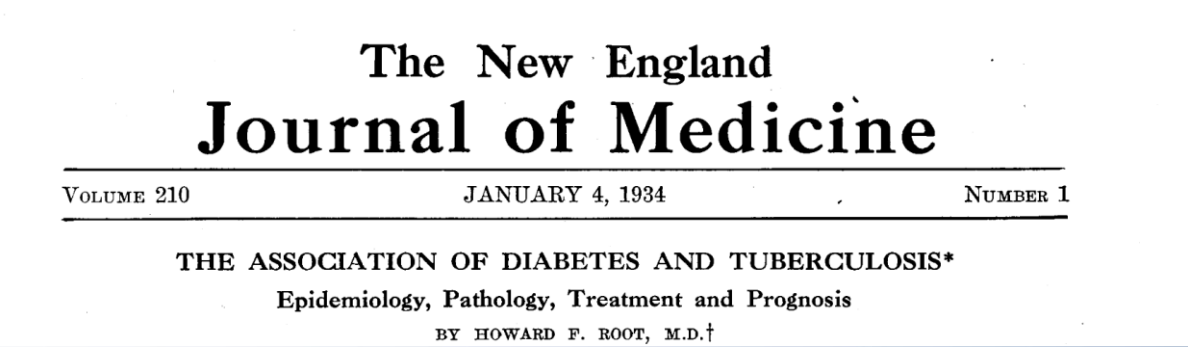
Conclusion: DM is associated with a two- to four-fold increased risk of active TB

Al-Rifai et al. PLoS ONE 12(11): e0187967

Effect of Diabetes on Immune Response to Mtb



Diabetes and Clinical Presentation of TB



The New England
Journal of Medicine

VOLUME 210 JANUARY 4, 1934 NUMBER 1

THE ASSOCIATION OF DIABETES AND TUBERCULOSIS*

Epidemiology, Pathology, Treatment and Prognosis

BY HOWARD F. ROOT, M.D.†

- Autopsy series of 126 patients: no pathological findings unique to “the tubercular diabetic”
- 245 TB cases in diabetic patients, “no special insidiousness” of signs or symptoms and similar CXR findings to non-diabetics
- Did note that TB developed most frequently in patients with poor diabetic control

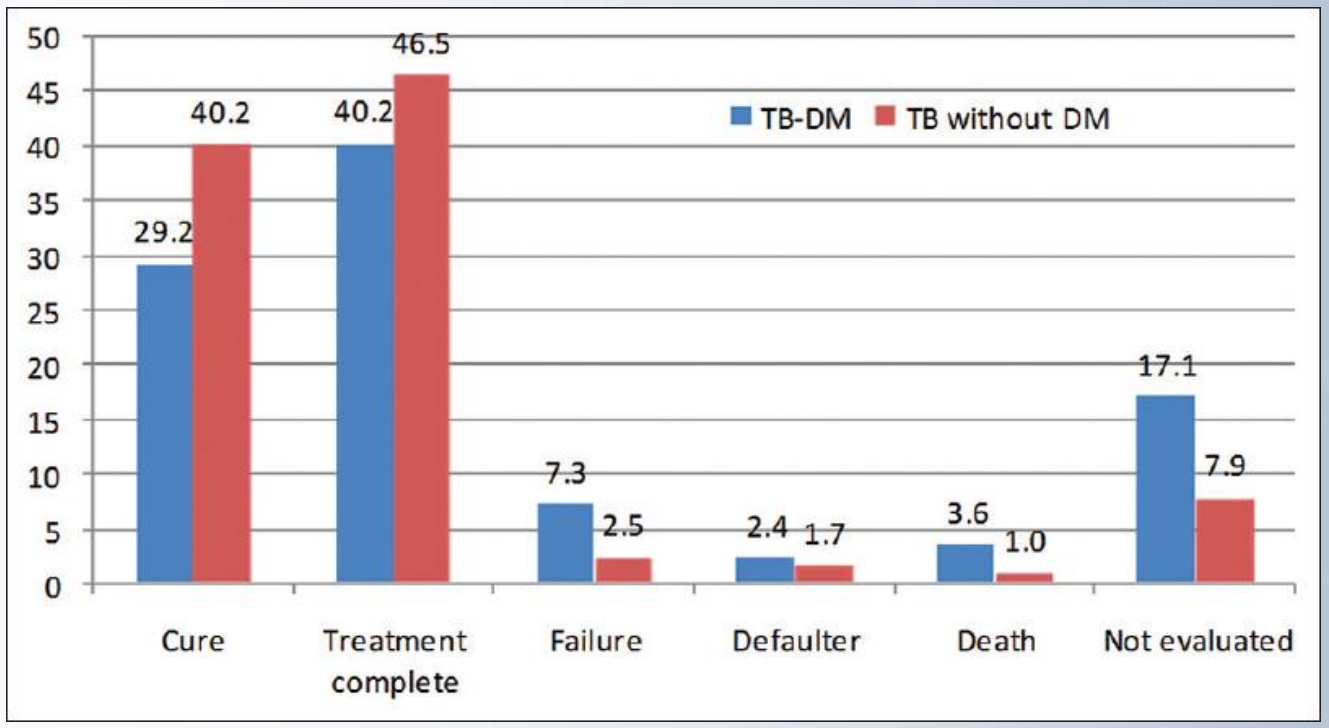
Dooley, & Chaisson, Lancet ID, Dec 2009

Does Diabetes Impact TB Treatment and Cure?

- Previously thought not to affect treatment
- Four studies from Baltimore, Texas, Taiwan and Indonesia reveal:
  - Delayed culture conversion
  - Higher mortality

Dooly, 2009; Restrepo 2008; Wang 2008; Alisahlanda,2007

Outcomes in TB patients with Diabetes



Outcome	Total *N* (%)	TB patients with DM *N* (%)	TB patients without DM *N* (%)	RR (95% CI)
Unfavorable	42 (6.9)	11 (16.2)	31 (5.8)	2.78 (1.46-5.28), *P*=0.002
Favorable	560 (93.1)	57 (83.8)	503 (94.2)	
Total	602 (100)	68 (11.2)	534 (88.7)	

RR=Risk ratio, CI=Confidence interval, TB=Tuberculosis, DM=Diabetes mellitus

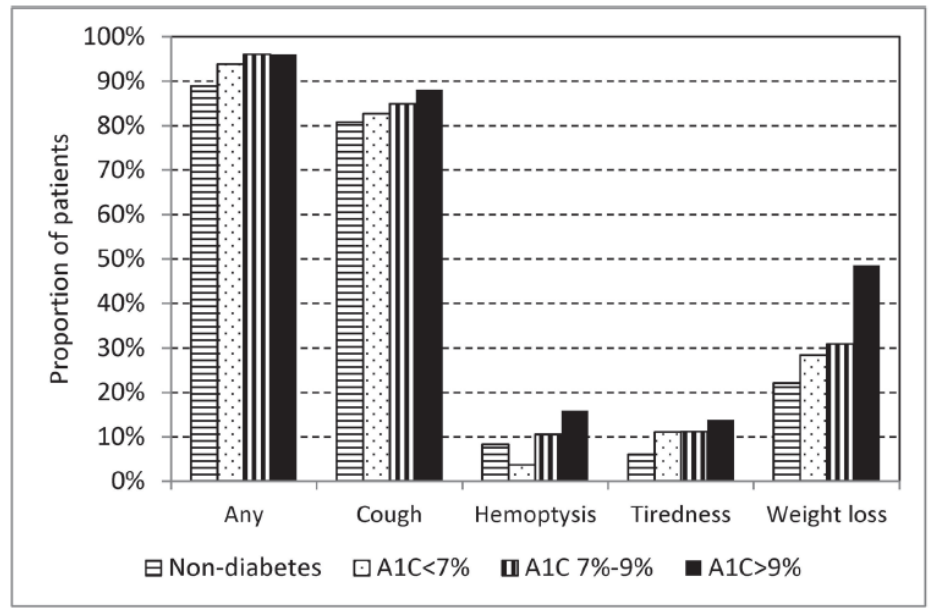
Sembiah Journal of Family and Community Medicine, 27(2):91-96

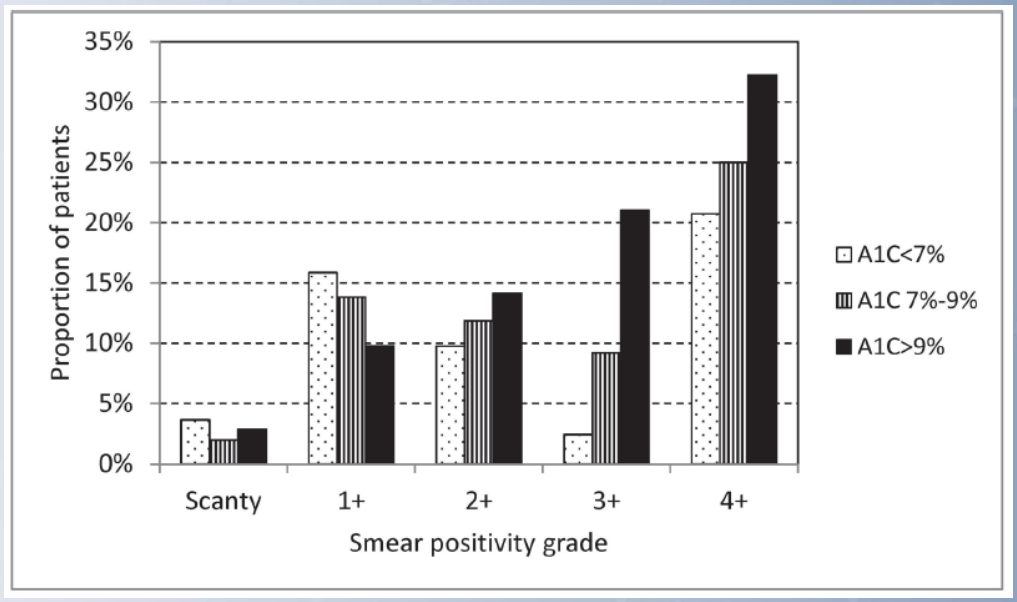
PLOS | ONE

RESEARCH ARTICLE

The Influence of Diabetes, Glycemic Control, and Diabetes-Related Comorbidities on Pulmonary Tuberculosis

Chen Yuan Chiang[1,2,3], Kuan Jen Bai[2,4], Hsien Ho Lin[5], Shun Tien Chien[6], Jen Jyh Lee[7], Donald A. Enarson[1], Ting-I Lee[8,9], Ming-Chih Yu[2,4]*





Chiang et al. PLoS ONE 2015 10(3): e0121698

Diabetic Neuropathy and Nephropathy in TB Patients

- **Diabetic neuropathy** at baseline complicates therapy due to INH-related neuropathy
  - Baseline assessment of neuropathy
  - Vitamin B 6 (pyridoxine) to all diabetics on INH or ethionamide
  - Fluoroquinolones may substitute if intolerant
- **Renal insufficiency** is associated with diabetes, especially long standing or poorly controlled diabetes
  - Adjust dose and dosing interval of EMB & PZA in those with Creatinine Cl < 30

Hepatotoxicity in TB Patients with Diabetes

- Diabetics have an increased risk of hepatotoxicity
  - Multiple medications
  - Fatty liver

- Monitoring and education are very important
  - Baseline and monthly liver enzymes
  - Educate regarding risk of liver toxicity, symptoms to watch for, and when to notify you

Relapse

- Relapse may be more frequent
- Shanghai study, 203 diabetics with TB followed for 2 years after standard treatment
  - 20% relapse rate in patients with DM (most Type 2)
  - 5% relapse rate in patients without DM

Zhang et al. Jpn J Infect Dis, 2009

Treatment of Culture-Positive Drug Susceptible Pulmonary TB

- **General conclusions from the literature**
  - 6 mo (26 wk) is the ***MINIMUM*** duration of RX
  - 6 mo regimens require **rifampin (and INH) throughout** and **PZA for the first 2 months**
  - 6 – 9 mo regimens are effective without INH if PZA given throughout
  - **Without PZA** - minimum duration is **9 months**
  - **Without rifampin** - minimum duration is **12 months (up to 18 months)**

Rifampin and Diabetes

- Rifampin induces CYP450 enzyme system increasing production of enzymes that metabolize many drugs
  - Increased metabolism results in lower blood levels of drug (20 – 40+%)
  - Affects many classes of diabetic medications

Hyperglycemia in Patients with TB

Blood glucose control may worsen while patients are taking Rifampin

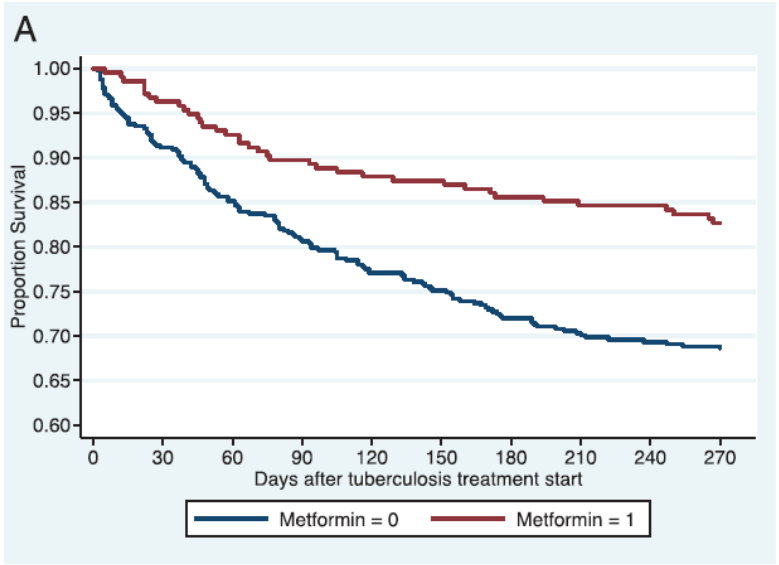
- Rifampin augments intestinal absorption of glucose
- Does so in both diabetics and non-diabetics

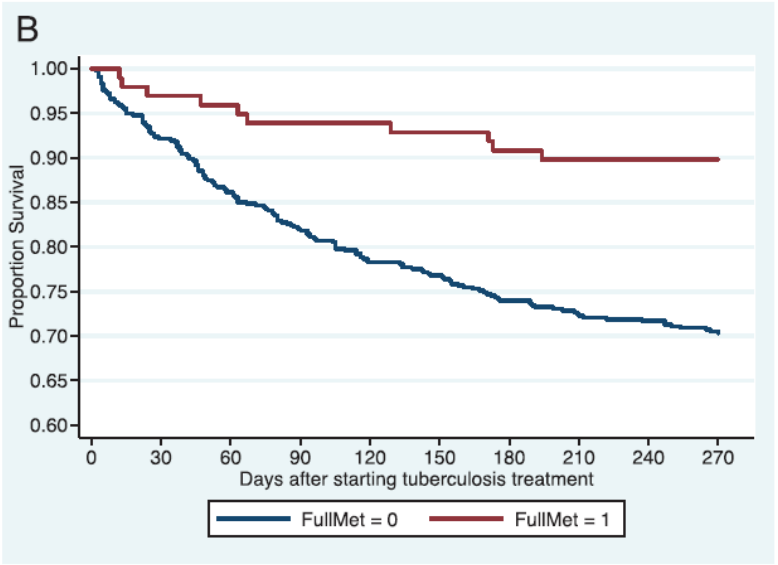
Infections impair glucose tolerance early in disease in both diabetics and non-diabetics

- Independent of rifampin, infection can lead to poor glucose control

New Options for Treatment…..?

Metformin Use Reverses the Increased Mortality Associated With Diabetes Mellitus During Tuberculosis Treatment



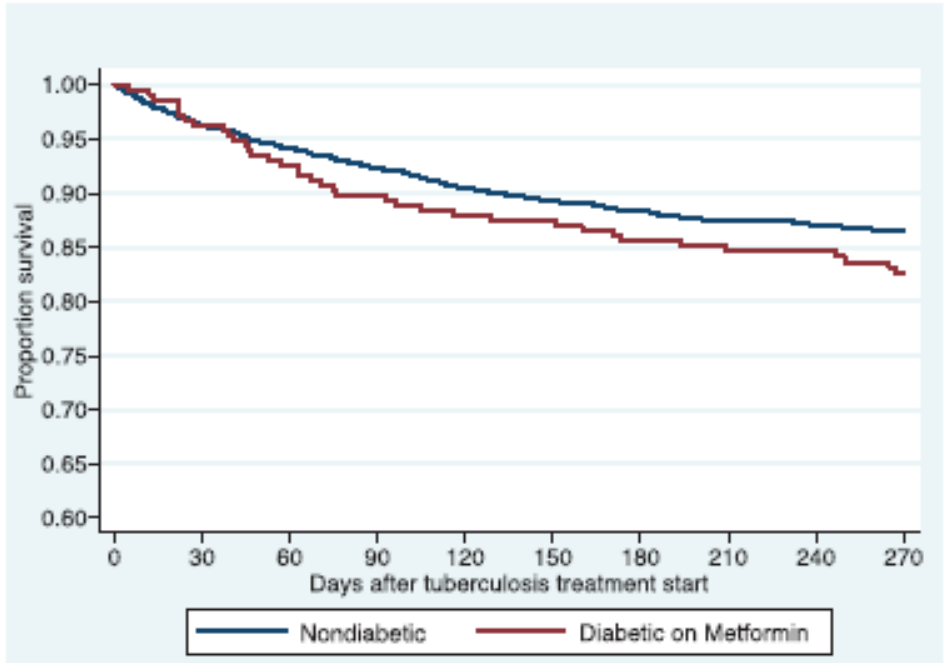


	Metformin (n=216)	Non-Metformin (n=418)	Total (n=634)	Log-Rank χ2
Death during tuberculosis treatment -%	17.6	31.3	26.7	<0.001

	Metformin (n=219)	Non-Metformin (n=358)	Total (n=577)	Log-Rank χ2
Death during tuberculosis treatment -%	10.2	29.7	26.7	<0.001

Degner et al. CID 2018; 66(2):198–205

Metformin Use Reverses the Increased Mortality Associated With Diabetes Mellitus During Tuberculosis Treatment



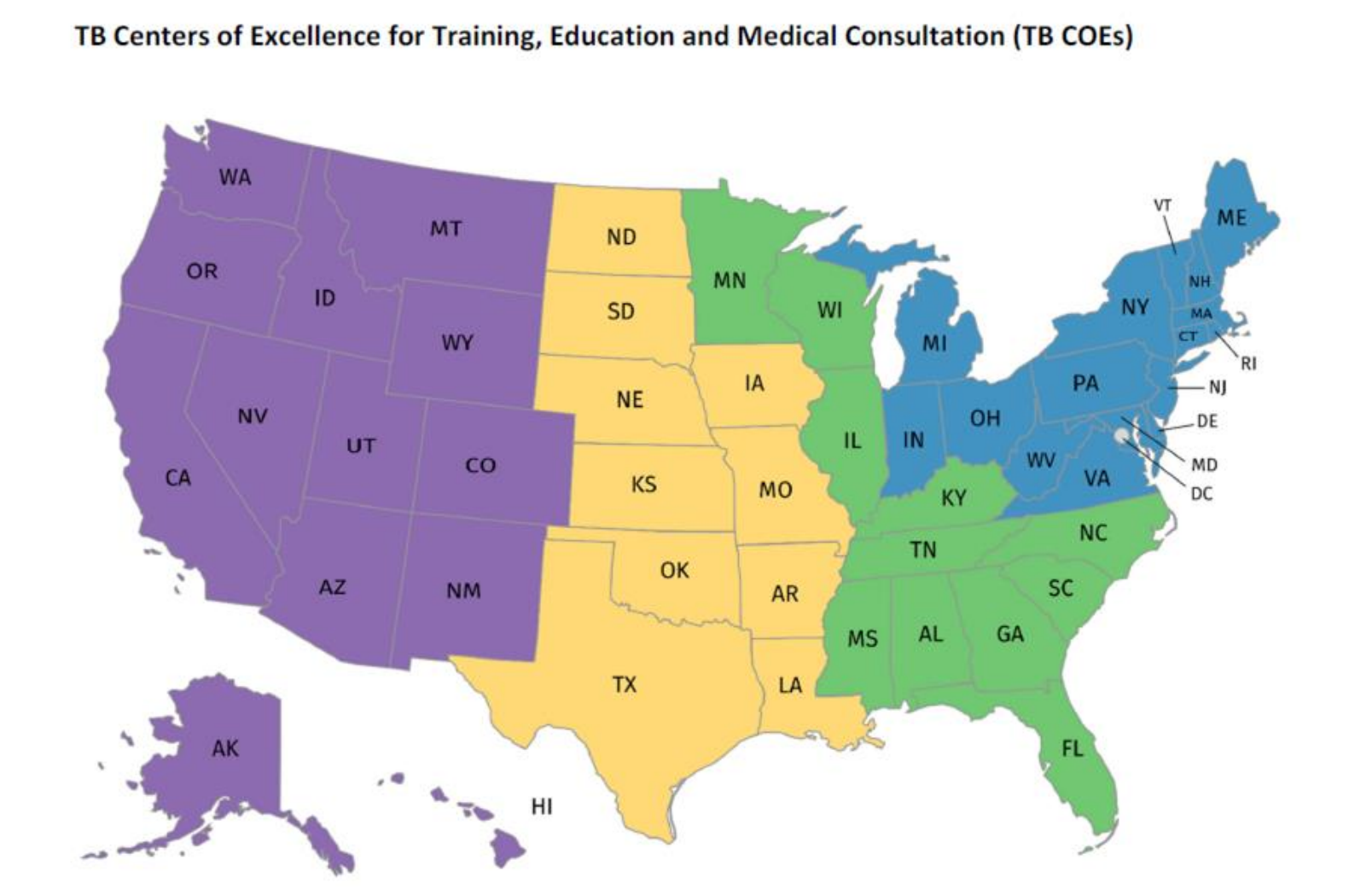
	DM on Metformin (n=216)	Non-DM (n=1,692)	Total (n=1,908)	Log-Rank χ2
Death during tuberculosis treatment -%	17.6	13.4	13.9	0.142

Degner et al. CID 2018; 66(2):198–205

What Can We Offer TB Patients with Diabetes?

- Watch glucose and HglA1C for trends.
- Educate on need to follow a healthy eating plan.
- Encourage physical activity for 30 to 60 minutes/ day.
- Stress the importance of taking medicines as directed.
- Encourage patients to quit smoking.

Heartland region slide here



Questions?

Lisa.armitige@dshs.texas.gov

1-800-TEX-LUNG

Thank You to Our Speakers!

- Brianna Monahan
- Lisa Armitige

CEU: www.ndhealth.gov/HIV/Provider

Next Lunch and Learn: November 25th at 12pm CT

- *HIV and Persons Who Inject Drugs*

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